Ardaman & Associates, Inc.
MEMORANDUM

TO: Tim Cotton, Agrifos Fertilizer Inc.

FROM: Nadim F. Fuleihan, Sc.D., P.E

DATE: September 10, 2007

SUBJECT: Emergency Situation Requiring Immediate Action, Agrifos Phosphogupsum Stack System, Pasadena, Texas

FILE NO: 07-122

As requested, I and my associate, Rob Werner, visited the site today to inspect firsthand the emergency situation that developed recently at the Agrifos phosphogypsum stack system in Pasadena Texas, and I participated in a meeting this afternoon with members of your Houston staff, other consultants, and representatives from the TCEQ, EPA, NOAA and Coast Guard as well as Exxon-Mobil and Terra. This memorandum summarizes key points that I made during the meeting and, in particular, the urgent need to remove process water from the system in a controlled manner in order to minimize the risk of subjecting the area to an uncontrolled catastrophic spill of much greater magnitude.

As a result of recent extreme rainfall events, the concrete wall surrounding the moat was reportedly overtopped on two occasions and one section of wall was subjected to uplifting of its foundation resulting in another release of process water from the system through the bayou into the Houston Ship Channel. During my inspection on September 10, 2007, the process water in the moat around the South Stack was essentially within inches of the rim of the wall at the depressed overflow section of the wall, and the gypsum stack was essentially full to capacity, with only about one foot of freeboard remaining in one of the compartments and about 18 inches of minimum freeboard remaining in the other compartment where the dike had recently been raised. Moreover, the North Stack (Stack No. 4) was also essentially full with about one foot of freeboard remaining in both the compartment atop the stack and the surge pond at the toe of the stack. In my professional opinion, this situation represents an extreme emergency requiring immediate action for the following reasons:

- One foot of freeboard on top of the stack is the absolute minimum that can be tolerated even under the most extreme emergency conditions because any additional rainfall on the stack or any significant sustained wind will likely cause overtopping and erosion of the crest road, potentially leading to an uncontrolled failure and a massive spill from a great height, with correspondingly high kinetic energy. The stack should normally be operated with 3.5 feet of freeboard, and the water level should only be allowed to surge to within one foot of the crest during extreme emergency water conditions and for a very short period of time because the risk of failure is high when the design freeboard is compromised as in the present situation.
- With only one foot of freeboard on top of the South Stack, the rim-ditches atop the stack in one of two compartments are submerged below water and can no longer be effectively used to quickly raise the perimeter gypsum dikes, thus aggravating an already critical condition over time. Moreover, the extent of any gypsum beaches

inboard of the rim-ditch is minimal, further complicating dike raising efforts with the current high water levels.

- The moat is essentially full almost to the overflow level, and the watershed of the moat encompasses a much larger stack slope area, so any small quantity of rainfall is likely to cause an uncontrolled release of process water from the relatively narrow moat, potentially undercutting the wall footing at the overflow location.
- Whereas the concrete wall surrounding the moat may be able to accommodate temporary surges in water level and the wall is structurally sound, it does not incorporate cut-off features that would control piping under sustained high water conditions. Hence, if the water level is not lowered in short order, there is a high likelihood that internal erosion might progress at potentially more than one location leading to undercutting and possibly overturning of some wall segments with associated uncontrolled releases of process water.
- The critical condition described above is further aggravated by the fact that we are still in the midst of the rainy season and potentially in an active hurricane season, and every inch of rainfall adds about 9 Million Gallons of water to the system. With an overall watershed to ponded area ratio (i.e., surge ratio) on the order of 3, the average water level in the system is expected to surge by about 3 inches in response to each inch of precipitation. For the moat surrounding the South Stack, the surge ratio is as high as 10, and, hence overtopping of the moat is quite likely under current conditions. Unless a significant quantity of process water is consumed or discharged in short order, the emergency situation is likely to be sustained for at least several months, through the hurricane season and possibly beyond, with continued threats of imminent accidental spill(s).
- In order to assist in alleviating this extreme emergency situation, it is recommended that Agrifos continue to operate the plant in a manner that optimizes process heat evaporative losses, and at the same time inform the regulatory agencies of the urgent need to remove process water from the system in a controlled manner in order to minimize the risk of an accidental spill, restore safe phosphogypsum stack system operating procedures (3.5-foot freeboards), and provide conditions suitable for raising the gypsum dikes.

To expedite removal of process water under such emergency conditions, it is recommended that Agrifos seek approval to: (i) discharge process water at the highest sustainable rate after adjusting the pH to above 3.5 (and preferably to about 4.0) by the controlled addition of soda ash or caustic; (ii) concurrently discharge lime treated process water routed through the Waste Water Treatment Plant with a pH in the range of 4.0 to 7.0 as long as the emergency conditions prevail; and (iii) explore any other possible means of consumption or water storage for potential implementation in the intermediate (as opposed to immediate) term .